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FOR

PESTICIDE APPLICATORS

INVOLVED IN

SKUNK RABIES CONTROL AND/OR SURVEILLANCE

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## RABIES - DESCRIPTION AND SIGNS

Rabies is an infectious viral disease which affects the central nervous system of warm-blooded animals. It occurs throughout the world and is fatal to man if not treated before the onset of symptoms. The infection is transferred in the saliva of rabid animals. The incubation period of the disease is usually more than 15 days in susceptible animals, but is highly variable. Early human symptoms include pain at the site of the wound, fever, headache, weakness, nausea, and poor appetite. This is followed by increasing uneasiness and excitement. Convulsions appear in the swallowing muscles and drinking becomes difficult or impossible. Unusual behavior may occur. If the excitement phase is survived; the victim becomes depressed. Paralysis then develops, followed by coma and death.

There are two types of animal rabies: aggressive and dumb. In the aggressive form, an infected animal becomes violent and may attack anything within its reach. The dumb form of rabies is characterized by confused, slow, or sluggish actions. In either case, the brain is infected and the signs may vary widely. For example, a rabid cow will butt a fence post or roar and bellow like a bull. Another sign in cattle is choking. The muscles in the throat area become impaired or paralyzed and give the animal the sensation of choking. The person who sticks his hand down the throat of an infected animal is exposed to saliva which may contain varying amounts of the virus. An animal staggering is exhibiting a typical sign. Sometimes a female will show artificial heat for up to six days. Drooling

is also a typical sign. Some animals die rapidly after signs appear; some take a number of days. Death usually occurs between one and six days with a norm of four days. These general signs may also apply to cats, dogs, horses, and wild-life.

Horses, however, at times have signs of the aggressive type. Infected horses actually try to destroy everything. Any change from normal behavior is suspect. An animal interested in drinking water but can't drink because its throat muscles won't function correctly may indicate the possible presence of rabies.

Infected skunks may or may not act normal. Since the disease affects the brain, an advanced infection causes abnormal behavior. It is this abnormal behavior that leads them to bite anything: posts, other animals, or people. Peripheral vision may be impaired and thus they tend to walk only straight ahead. Hearing is also likely to be impaired so they may not react to such noises as the barking of dogs.

The virus content in the saliva of an obviously sick skunk is extremely heavy and so the bite of a skunk must be considered serious. A bite that breaks the skin will infect other animals or humans. People may be exposed to the disease when treating sick animals or when keeping skunks as pets.

Bats may also transfer rabies to humans, pets, livestock and wildlife. Rabies was first detected in native Montana bats at Hamilton in 1954. There are 13 species of bats native to Montana; of these 11 have been studied, and rabies was found in

in 8 of those 11. It is expected that any colony tested would have a prevalence of around 1%. Although rabid bats do not show classical rabies behavior, they definitely show behavior abnormal enough to arouse suspicion. If abnormal bats are tested for rabies, an incidence of about 10% is expected. The bat seems to be increasing in importance as a source of rabies exposure to man and his companion animals. A bat or a skunk is considered rabid unless found otherwise.

#### RABIES IN MONTANA

Animal rabies was infrequently reported in Montana prior to the mid-1960's. Sporadic outbreaks were reported in domestic species, primarily dogs. The first case of skunk rabies was diagnosed in 1964. An infected striped skunk was found in Fallon County in southeastern Montana. From 1964 through September 1981, a total of 500 cases of skunk rabies have been diagnosed in 28 counties. The majority of cases have been detected in north-central and eastern Montana (Figure 1).

Skunks are the primary hosts for the disease in Montana. The disease may have come from known skunk rabies areas of Saskatchewan and North and South Dakota.

Although skunk rabies is common throughout most of Montana, it is not widespread throughout entire skunk populations. Research has shown that apparent "pockets" of rabid animals exist throughout broad regions of skunk habitat. While rabies can be contracted by all warm-blooded animals, it does not move like an epidemic throughout animal populations.

## MONTANA

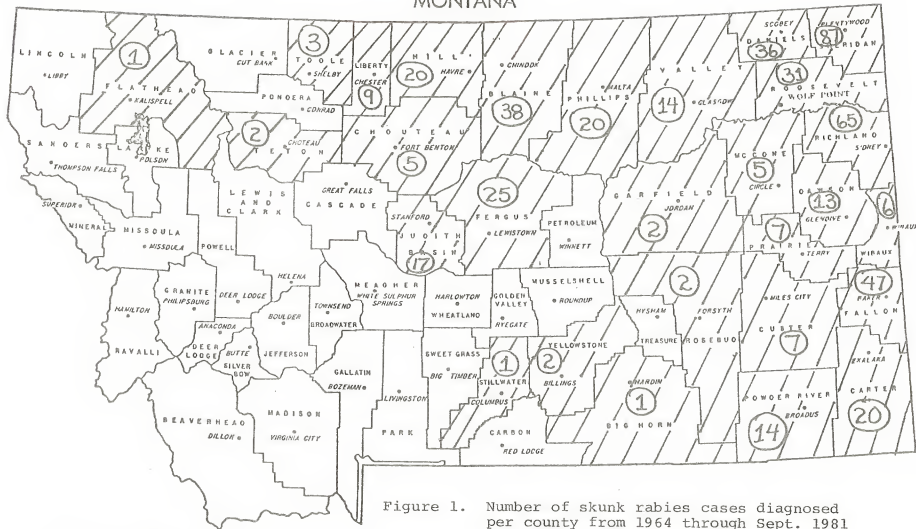


Figure 1. Number of skunk rabies cases diagnosed per county from 1964 through Sept. 1981



Table 1. NUMBER AND RESULTS OF SKUNKS, DOGS, CATS, AND CATTLE  
TESTED FOR RABIES FROM 1964 THROUGH 1981<sup>1</sup>

YEAR	SKUNK		DOG		CAT		CATTLE	
	POS.	*TE	POS.	TE	POS.	TE	POS.	TE
1964	5	27	0	48	0	25	0	16
1965	2	10	0	50	0	26	1	5
1966	15	89	0	48	0	47	0	19
1967	3	88	0	47	1	47	1	11
1968	7	38	0	34	0	46	1	4
1969	4	16	0	38	0	30	0	6
1970	0	27	0	41	1	53	0	1
1971	1	29	1	39	0	39	0	22
1972	5	49	0	62	0	55	0	13
1973	38	257	0	67	0	74	1	16
1974	36	566	0	89	0	84	1	9
1975	152	691	1	92	8	150	2	25
1976	73	162	0	92	3	115	5	24
1977	38	137	2	89	0	95	3	10
1978	15	53	0	98	0	108	0	7
1979	7	56	0	99	0	92	0	19
1980	36	96	1	114	0	91	2	20
1981 <sup>1</sup>	63	242	4	129	10	207	3	23
TOTALS	500	2633	9	1276	23	1384	20	250

\*TOTAL EXAMINED

(Information collected from the Montana Department of Livestock  
Diagnostic Laboratory, Bozeman, Montana)

1 - January through September 1981

Skunk rabies cases have been diagnosed in all months of the year. Data collected over 15 years has shown that almost 70% of the diagnosed cases occur in the months of April, May, June, and July. These peaks seem to coincide with the skunk's social habits. Courtship and mating occur in late February or early March. After a 64 day gestation, parturition occurs about early May. These juveniles are weaned in late June and July and are assimilated into the general skunk population. This explanation may account for the seasonal increase of skunk rabies caused by an increased skunk to skunk contact and physiological stress.

Beginning in April of 1973, a dramatic increase in the number of skunks infected with rabies was diagnosed at the Department of Livestock Laboratory in Bozeman, Montana. The increase of skunk rabies cases may have resulted from an actual increase in the incidence of the disease or the increase in rabies control and surveillance. The latter action resulted in greater numbers of skunks being tested for rabies. The outcome has been the detection of more cases of infected animals (Table 1).

A skunk rabies control program of trapping and shooting was started during March and April of 1973 by the Montana Department of Livestock to suppress skunk populations in the immediate vicinity of confirmed rabid skunk cases. These control measures were ineffective and costly. Costs of using steel traps were extremely high and considered impractical for the scope of the rabies problem in Montana. Steel traps also proved to be of limited value during winter and early spring

months when traps would frequently "freeze down" at night or "wash out" during rain storms. Trapped skunks were also a hazard to people and domestic animals since the trapped animal would frequently attract attention. Dogs fighting with a trapped, rabid skunk may become exposed and people attempting to free the skunk could be bitten or scratched.

In May of 1973, a formal request was made by the Montana Department of Livestock to the U.S. Environmental Protection Agency for the use of strychnine-treated eggs to be used in an emergency skunk rabies control program. An environmental impact statement outlining the purpose and objectives of the program was prepared. On June 6, 1973, the Environmental Protection Agency announced it had no objection to the Montana Department of Livestock conducting a rabies control program using strychnine-treated eggs.

Since the beginning of the Department of Livestock's skunk rabies control program in June 1973, considerable information has been collected concerning: 1) the effectiveness of strychnine-treated eggs in reducing skunk populations within established control areas; 2) the effects of strychnine-treated eggs on non-target species; 3) the foci of skunk rabies in an area using surveillance activities, and 4) the most effective means of implementing and administering a skunk rabies control program in Montana. These data resulted in the adoption of a formal Skunk Rabies Control Policy by the Montana Department of Livestock on January 21, 1975. This policy states:

"It shall be the policy of the Department of Livestock as adopted by the Board of Livestock on January 21, 1975,

that when it is determined by the State Health Officer of the Department of Health and Environmental Sciences or the State Veterinarian of the Department of Livestock that the proximity of rabid skunks to humans or livestock poses a danger to the health of either or both, then the Department of Livestock may pursue one or more of the following approaches:

1. Control of skunk populations within a three-mile radius encompassing areas of human or domestic animal habitation where rabies has been diagnosed in skunks.
2. Surveillance of skunk populations outside the three-mile radius in order to determine the perimeter of rabies within any county and/or adjacent counties.
3. Surveillance of skunk populations to monitor the migration of rabies as a known disease in Montana and to support encephalitis studies in skunks from which rabies is clinically indistinguishable. (This is a research-oriented effort to determine if rabid skunks are spreading in Montana, and if so, to institute early control procedures before an outbreak reaches emergency proportions.
4. Provide an information-education program on skunk rabies in counties where skunks are determined the vector species.

Since the adoption of the Skunk Rabies Control Policy by the Department of Livestock in January 1975, skunk rabies control and/or surveillance programs have been initiated in 30 of Montana's 56 counties.

## PREVENTION OF HUMAN EXPOSURE

Every year there are several instances of human exposure to rabies in Montana. These exposures could often have been prevented. Pets, especially dogs and cats, should be vaccinated for rabies and periodic booster shots kept current. Local veterinarians should be consulted concerning such vaccinations. Avoid stray or feral dogs and cats. Avoid handling sick or strange acting animals without consulting a veterinarian. Montana law prohibits the keeping of skunks, bats and racoons as pets.

Good housekeeping around livestock and ranch or farm buildings, removal of rubbish or junk piles, and repair or construction of building foundations all help to keep skunks from taking up residence in close proximity to humans, pets, and livestock. Uneaten pet foods in yards also serve as a strong attraction for skunks. Pets should be fed in areas inaccessible to skunks, or uneaten portions of pet food should be removed between feedings.

If bitten by an animal, seek medical aid as soon as possible. Try to confine the biting animal until a veterinarian can check for rabies. If exposure to rabies has occurred, a series of inoculations will be required.

## COLLECTION OF SPECIMENS

It sometimes becomes necessary to obtain samples of skunks for analysis for rabies. Skunk specimens should always be collected:

- 1) when a human has been bitten by a skunk;
- 2) when pets or livestock have been bitten or it is reasonable to suspect they may have been bitten by a skunk;
- 3) when a strange acting or aggressive skunk is in close proximity to humans, pets, or livestock.

Occasional research or surveillance programs conducted by the Montana Department of Livestock may require the collection of skunks.

Care in collecting and handling skunks is essential to prevent possible exposure to rabies. Suspect skunks should be disposed of, preferrably by shooting. Do not damage the head area since intact brain tissue is needed to diagnose rabies. Use a sharp shovel to sever the head from the body. Place a plastic freezer or bread bag inside out over a gloved hand and forearm. Pick up the head with the wrapped hand and then carefully turn the bag right side out back down over the hand and skunk head. Avoid direct contact with bare skin. Securely fasten the bag closed and take the specimen to the nearest veterinarian. If delivery to a veterinarian within a few hours is impossible, freeze the head and deliver it as soon as possible. The specimen will then be sent to the Department of Livestock Diagnostic Laboratory in Bozeman for analysis. Results of the analysis will be forwarded to Department of Livestock personnel. Rabies control agents will be notified if a control program is required.

#### ODOR REMOVAL

Skunk odor is so persistent that no treatment is likely to be completely satisfactory. To reduce odor persistence, try these suggestions:

- 1) To decontaminate clothing, soak clothing in a solution of 1 part household ammonia to 20 parts water.
- 2) To neutralize skunk odor on skin, wash area with a solution of 1 part household ammonia to 20 parts of water or use tincture of green soap, which is available at a local pharmacy.

Several commercial products are also available for both clothing and skin cleansing.

#### SKUNK RABIES CONTROL PROCEDURES

Rabies control agents are hired on a part-time or per-case basis by the Montana Department of Livestock. These agents are trained and supervised by Department of Livestock state veterinarians and licensed by the Montana Department of Agriculture. Rabies control agents are paid for mileage and a maximum wage of \$35 per day (8 hours maximum per day) and 20¢ per mile. Supplies and equipment are furnished by the Department of Livestock.

#### PROVISIONS FOR USE OF STRYCHNINE BAITS

The U.S. Environmental Protection Agency has issued a specific exemption to the Montana Department of Livestock for the use of strychnine eggs to control rabid skunks. The use

of these baits is subject to the following provisions and these provisions will be strictly followed:

- 1) All personnel using the eggs and baits will be trained, licensed pesticide applicators. Only employees or authorized agents of the Department of Livestock are allowed to use the baits.
- 2) Rabies control agents will obtain permission from Montana Department of Livestock state veterinarians before any skunk control work is initiated.
- 3) The eggs and baits will be placed only on lands where a premise entry agreement has been signed by the landowner, administrator, or lessee.
- 4) A maximum of 500 strychnine egg baits or lard baits may be placed within a three-mile radius per positive rabies case where skunks are determined as the vector species, or per county for surveillance purposes.
- 5) A maximum of two strychnine egg baits or lard baits per setting may be placed only in the following skunk habitat: skunk dens, holes, garbage dumps, road culverts, junk piles, or under nonoccupied buildings. No baits may be placed in the open, but must be under cover at all times.
- 6) Each strychnine egg bait will be stamped at least 3 times in red with the word "POISON".
- 7) The eggs and baits will contain a green dye for identification purposes.



- 8) Each egg will be injected with 1 cc of strychnine solution. This strychnine solution will be premixed and furnished by Department of Livestock personnel.
- 9) Warning signs will be placed at premise entry locations. Stake warning signs will be stationed within three feet of placed eggs and lard baits.
- 10) Treated eggs and lard baits remaining after a 30-day period from date of placement will be collected and destroyed. Freezing will not detoxify strychnine.
- 11) All retrieved and excess eggs and baits will be disposed of in a sanitary landfill or buried in safe locations. Animals taken with baits will be buried to prevent possible nontarget species poisoning.
- 12) All prepared eggs and baits will remain under lock and key until time of usage.

#### PROCEDURE FOR PREPARING STRYCHNINE EGGS

Use the following procedure when preparing strychnine egg baits.

- 1) Use large chicken eggs and warm to room temperature if possible.
- 2) Stamp each egg at least 3 times using the "POISON" stamp and red ink.
- 3) Drill a hole in the egg shell at the large end of the egg using a California bleeding needle.
- 4) Attach a hypodermic needle to a syringe and fill the

syringe with the required amount of strychnine solution.

- 5) Insert the hypodermic needle into the previously drilled hole and inject lcc of dyed strychnine solution into each egg.
- 6) Rinse the needles and syringe thoroughly with water when finished.

#### LARD-PARAFFIN BAITS

Lard-paraffin baits are seldom used today, although they have been used extensively in the past for skunk rabies suppression work. A lard-paraffin bait is a cube measuring approximately 5/8" on a side and is composed of two parts lard and one part paraffin. The cube weighs about five grams and contains .012 grams of strychnine alkaloid (less than 1%). Precise formulas are used in the preparation of these baits. These baits have their greatest application during prolonged cold weather where chicken eggs would freeze and be inedible by target species. Their use has been largely discontinued, except in special circumstances, because of greater selectivity against nontarget species using egg baits. Where temperatures cause freezing of eggs, we prefer to hold off toxicant use until temperatures moderate.

#### SAFETY PROCEDURES

- 1) Always read the label on the container.
- 2) Keep the strychnine alkaloid container, eggs, and paraffin-lard baits under lock and key at all times.

- 3) Keep strychnine and treated eggs away from children and animals.
- 4) Keep strychnine and treated eggs away from all feeds and foodstuffs.
- 5) All retrieved or excess egg and paraffin lard baits shall be disposed of in an approved sanitary landfill. Containers will be disposed of in a similar manner.
- 6) Prepare the egg and lard baits only according to the established formulations.
- 7) Wash hands thoroughly if spillage occurs.
- 8) All containers should be labeled "POISON".

#### FIRST AID

Strychnine alkaloid is considered to be highly toxic. When it is ingested it is absorbed through the gastrointestinal tract with symptoms appearing from 5 to 30 minutes after ingestion. Toxic symptoms are due principally to increased reflex excitability and are characterized by convulsive spasms.

If poisoning occurs, call a physician immediately. If less than ten (10) minutes have passed since the poison was taken, use any means available to induce vomiting to remove strychnine from the stomach. If more than ten (10) minutes have passed, do not induce vomiting, as this may cause the onset of convulsions. Have the victim lie down in a quiet, darkened room and keep him warm until the physician arrives.

## ENVIRONMENTAL IMPACT

If used according to the recommended procedures, there should be little, if any, adverse environmental effects. However, since strychnine is nonselective in its ability to kill, bait placement is important so that the taking of non-target species will be kept to a minimum. As a further precaution and to prevent the possibility of secondary poisonings from occurring, all animals destroyed will be buried.

All landowners, administrators, or leasees should be well informed of the potential hazard of the strychnine eggs to children, pets, livestock, and wildlife.

## REPORTS

Rabies control agents will be required to complete a rabies investigation form, weekly reports, and monthly reports for each case they work on. Department of Livestock Veterinarians will familiarize the agents with these forms. In addition, receipts for any supplies or materials purchased for rabies control purposes should be retained. These forms and receipts must be mailed to the local Department of Livestock veterinarian upon completion of each rabies control case.

Field diaries and premise entry agreements must also be completed for each rabies control case. The field diary is used to assist the agent in keeping track of bait placements and completing weekly and monthly reports. Field diaries and premise entry agreements are for the control agents use and need not be returned to the Department of Livestock.

## BIOLOGY OF THE STRIPED SKUNK

The striped skunk (Mephitis mephitis) is distributed throughout Montana. It has adapted very well to human presence, particularly within cultivated areas. About the size of a house cat, it may be recognized by its black body, narrow white stripe up the middle of the forehead, and broad white area on the nape which usually divides into a "V" at the shoulders. The resulting two white lines may continue back to the base of the bushy tail, which may or may not have a white tip. Scent glands are well developed.

Chiefly nocturnal, striped skunks start hunting shortly after sundown and retire about sunrise. They are omnivorous, feeding primarily on mice, eggs, insects, grubs, berries, and carrion. Dens are located in ground burrows and beneath abandoned buildings, boulders, wood and junk piles. Several females may den together in winter; males tend to be solitary. Skunks are not true hibernators and may often appear on warm nights during the middle of winter. A population of one skunk per 10 acres in good habitat is considered high. Skunks mate from February through March and produce an average of 6-7 young after a 63-day gestation period. Young accompany the mother until late June or July.

The normal wild striped skunk is high-strung, impatient, and generally irritable to any interference, especially if it is caused by man. If a person advances, a skunk will generally raise the tail higher, stamp the front feet, swing its body around to the side closest to the intruder, and scent or sometimes run at the intruder.

The rabid skunk, on the other hand, is strictly on the offensive. It may not raise its tail when it first observes another animal. It may charge with its tail down or dragging on the ground. Many rabid skunks in the latter stages fail to scent. A rabid skunk usually culminates an attack with rapid, severe biting. Skunk bites are usually multiple, close together, and rather deep puncture-type wounds.



